2.0 Technical Management Plan

2.1 Guidance, Regulations, and Policy

This Technical Management Plan details the approach, methods, and operational procedures to be used to perform all surface clearance actions of MEC on Culebra Island and adjacent cays, in Puerto Rico. The work to be completed during this task order will comply with the Scope of Work (SOW) (included as Appendix A), this Work Plan (including all appendices), and the following reference documents:

- CERCLA of 1980, Public Law 96-510, 94 Stat. 2767, 42 United States Code (USC) 9601, Chapter 103
- Puerto Rico Law 134, "Explosives"
- 27 Code of Federal Regulations (CFR) Part 555, Commerce in Explosives
- 29 CFR, Labor Standards
- 29 CFR 1910.120/1926, Occupational Safety and Health Standards
- 49 CFR Parts 100-199, Transportation
- 40 CFR, Parts 260 through 270, United States Printing Office latest edition
- 40 CFR, Part 300, Environmental Protection Agency (EPA) National Contingency Plan
- Federal Acquisition Regulation (FAR) 45.5 and its supplements, Management of Government Property in the Possession of Contractors
- DoD 4160.21-M, Defense Materiel Disposition Manual
- DoD 4160.21-M-1, Defense Demilitarization Manual
- DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards
- AR 190-11, Physical Security of Arms, Ammunition, and Explosives
- AR 200-1, Environmental Protection and Enhancement
- AR 385-10, The Army Safety Program
- AR 385-40, Accident Reporting and Records with USACE Supplement
- AR 385-64, United States Army Explosives Safety Program
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- Headquarters, Department of the Army (HQDA) Letter 385-00-2, DACS-SF, Explosives Safety Policy for Real Property Containing Conventional Ordnance & Explosives Response Activities, 30 June 2000
- Materiel Response Activity Interim Guidance, 19 March 1998
- HQDA Policy Memorandum, Munitions Response Terminology, 21 April 2005

- Engineer Regulation (ER) 200-3-1, FUDS Program Policy
- ER 385-1-92, Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities
- ER 385-1-95, Safety and Health Requirements for Ordnance and Explosives (OE) Operations
- ER 1110-1-8153, Ordnance and Explosives Response
- Engineer Pamphlet (EP) 75-1-2, UXO Support During HTRW and Construction Activities
- EP 385-1-95a, Basic Safety Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations
- EP 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects
- EP 1110-1-18, Ordnance and Explosives Response
- Attachment to Chapter 20, EP 1110-1-18, UXO Personnel and Experience Hierarchy
- Engineer Manual (EM) 200-2-1, Technical Project Planning (TPP) Process
- EM 385-1-1, Safety and Health Requirements Manual
- EM 1110-1-1200, Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects
- EM 1110-1-4009, Engineering and Design, Ordnance and Explosives Response
- Pertinent government-furnished unclassified Technical Manual (TM) 60-series publications
- TM 60A-1-1-31, EOD Procedures: General Information on EOD Disposal Procedures
- TM 60A-1-1-22, EOD Procedures: General EOD Safety Precautions
- NIOSH (National Institute for Occupational Safety and Health) / OSHA (Occupational Safety and Health Administration) / USCG (United States Coast Guard) / EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985
- Alcohol, Tobacco, and Firearms Publication (ATFP) 5400.7, Alcohol, Tobacco, and Firearms Explosive Laws and Regulations
- TM 9-1300-200, Ammunition General
- TM 9-1300-214, Military Explosives
- TM 9-1375-213-12, Operator's and Organization Maintenance Manual (Including Repair Parts and Special Tools List); Demolition Materials

- Technical Bulletin (TB) 700-2, Department of Defense Ammunitions & Explosive Hazardous Classification Procedures
- Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites, August 1998 (terminology update March 2000)
- Technical Paper (TP) 16, Methodologies for Calculating Primary Fragment Distances, Department of Defense Explosives Safety Board (DDESB)

2.2 Recovered Chemical Warfare Materiel

A review of the records indicates that no CWM was employed at this site; therefore, exposure to chemical warfare materiel is not anticipated. If MEC personnel encounter any item that cannot positively be identified as conventional MEC, EEG personnel will cease the operation immediately, evacuate, and secure an area 500 meters around the item. UXO personnel will take a position 50 meters upwind of the MEC, in an area where the site can be observed at all times. The CEHNC safety specialist, the CEHNC project manager, and the Huntsville CW Design Center (Mr. Wilson Walters) at 256-895-1578 will be notified of the situation.

2.3 Munitions and Explosives of Concern and Off-Site Disposal

2.3.01 **Table 2-1** provides a summary of MEC suspected to be encountered in each removal area.

Table 2-1. Expected Munitions and Associated Removal Areas

Removal Area	Possible Munitions
Cerro Balcon	81 mm practice HE mortar, 3-inch Stokes, 4.2-inch mortar, *75 mm projectile*
Isla Culebrita	*20 mm HEI,* 75 mm projectile
Cayo Botella	*6-inch naval projectile*, MK 76 practice bomb with MK 4 fuze
Cayo Alcarraza	*MK 83 1,000-pound bomb*
Los Gemelos	*MK 83 1,000-pound bomb*, Bullpup with inert warhead
Cayo Lobo	*MK 76 25-pound practice bomb* with Mk4 spotting charge
Cayo del Agua	*76mm HE*, MK 76 practice bomb
Cayo Tiburon	*MK 83 1,000-pound bomb*
Cayos Genequi	*MK 82 500-pound bomb*
Italicized items = MGFD	

2.3.02 It is planned that all MEC disposals will be completed on site. In case of a situation that prevents the destruction of MEC on site, the CEHNC safety specialist will be notified.

2.3.03 After positive identification (ID) of an item and determination of fuze condition, MEC that is determined by the senior UXO supervisor (SUXOS), the UXO quality control / safety officer (UXOQC/SO), and the CEHNC safety specialist to be acceptable to move may be carefully moved for consolidation with other items within the site prior to destruction.. The item will be carefully placed into a container, prepared by placing a layer of sand on the bottom to restrict movement and mitigate shock. Larger ordnance items may be loaded onto the transport vehicle without containerization as long as they can be properly secured to the vehicle to prevent movement. Items deemed acceptable to move by CEHNC will not contain any means of self-detonation or active fuzing.

2.3.1 Transportation of MEC

Transportation of MEC will be performed as detailed in Chapter 3.

2.3.2 Temporary Storage of MEC

Temporary storage of MEC is not anticipated on this project.

2.3.3 Off-Site Disposal Alternatives

Due to the nature of the suspected MEC and MC materials, and the remote nature of all sites within this task order, the need for off-site disposal is not anticipated.

2.3.4 Unidentifiable MEC

If unidentifiable MEC is discovered, the default separation distance specified in DDESB TP 16 will be used. The minimum separation distances (MSDs) will not be less than 1,250 feet. The OE safety specialist will be contacted for assistance in identifying the MEC. As per EP-385-1-95a, Section 9a, MEC Procedures Safety Precautions: “Every effort will be made to identify a suspect military munition. Under no circumstances will any MEC be moved in an attempt to make a definitive identification. The military munition will be visually examined for markings and other external features such as shape, size, and external fittings.”

2.4 Technical Scope of the Project

The SOW for this project is included as Appendix A of this Work Plan. The tasks included are discussed in the following subchapters.

2.4.1 Site Preparation

2.4.1.1 Grid Layout

The grid corners will be determined by the map projection locations of the grid corners of a 200-by-200-foot grid using the geographic information system (GIS). The coordinates of the grid corners will be given to a Puerto Rico-licensed surveyor, to locate the grid corners in the field. The surveyor will provide the actual coordinates and elevations of the corners to sub-meter accuracy. Actual grid areas will be calculated using the measured sides of the grid in the field. Grid maps of the sites are presented in Appendix B.

EEG may subdivide a grid based on topographic, vegetation, and other logistical constraints. The corners of the resulting subgrids will be located using the Trimble ProXR global positioning system (GPS). The location of each subgrid will be identified by its relationship to the entire grid (i.e., northwest corner, southeast corner of southwest quarter, etc.). Each subgrid will be searched and subjected to its own quality assurance (QA) and quality control (QC) approval.

2.4.1.2 Lane Width

After the boundaries have been marked, lanes (no wider than 4 feet) will be established in a pattern that will allow MEC personnel optimum sweep rates. The location of MEC will be recorded using a GPS, and all related information (i.e., size and condition) will be recorded in a field log.

2.4.2 Tools and Techniques

2.4.2.1 Vegetation Clearance

2.4.2.1.01 Prior to performing vegetation clearance, a qualified tropical botanist will survey the area of the investigation to identify protected species and habitats. All protected trees and habitats found will be delineated and placed on a map. EEG will follow protected species protocols provided in Appendix J.

2.4.2.1.02 EEG will use a variety of vegetation-removal equipment to include a bladed trimmer with several types of blades to cut vegetation from the site grids. The least amount of vegetation will be removed to allow EEG UXO personnel to properly work the geophysical equipment to locate surface anomalies. EEG personnel will wear the proper personal protective equipment (PPE) for the safe operation of this equipment.

2.4.2.1.03 When tree removal is necessary, a chain saw will be used to cut trees and limbs less than 2 inches in diameter. Larger trees and limbs will be cut only as a last resort.

2.4.2.1.04 Vegetation removal will first be conducted along the grid boundaries and later within the grids to ensure that the boundaries are properly located.

2.4.2.2 Description of the Ordnance Locators to be Used

As the SOW involves a surface removal operation, EEG is preparing to use White's Spectrum XLT electromagnetic detectors or a Schonstedt GA-52 CX flux gate magnetometer to aid in visual detection of MPPEH at the surface (however, other equipment may be used upon CEHNC request). This instrument has been chosen due to its ability to detect MPPEH in areas of highly mineralized soils. The White's electromagnetic detectors and the Schonstedt GA-52 CX flux gate magnetometer will be able to detect items as small as a 20 mm projectile at or near the surface at the site. Further description of the geophysical equipment and the operation is provided in Chapter 6 of this Work Plan.

2.4.2.3 Location Survey

2.4.2.3.01 Geospatial data will be collected in accordance with DID MR-005-07. EEG will use a Puerto Rico-licensed surveyor to determine the coordinates of the grid corners using the presently existing benchmarks to Class I Third Order or better. The Puerto Rico-licensed surveyor will use either differential (post-processing) or kinematic survey techniques to determine the locations of the grid corners to sub-centimeter accuracies.

2.4.2.3.02 During the field effort, EEG will determine the locations of the MEC and the demolition locations using a Trimble ProXR GPS. The accuracy and methods are discussed in Chapter 7 of this plan.

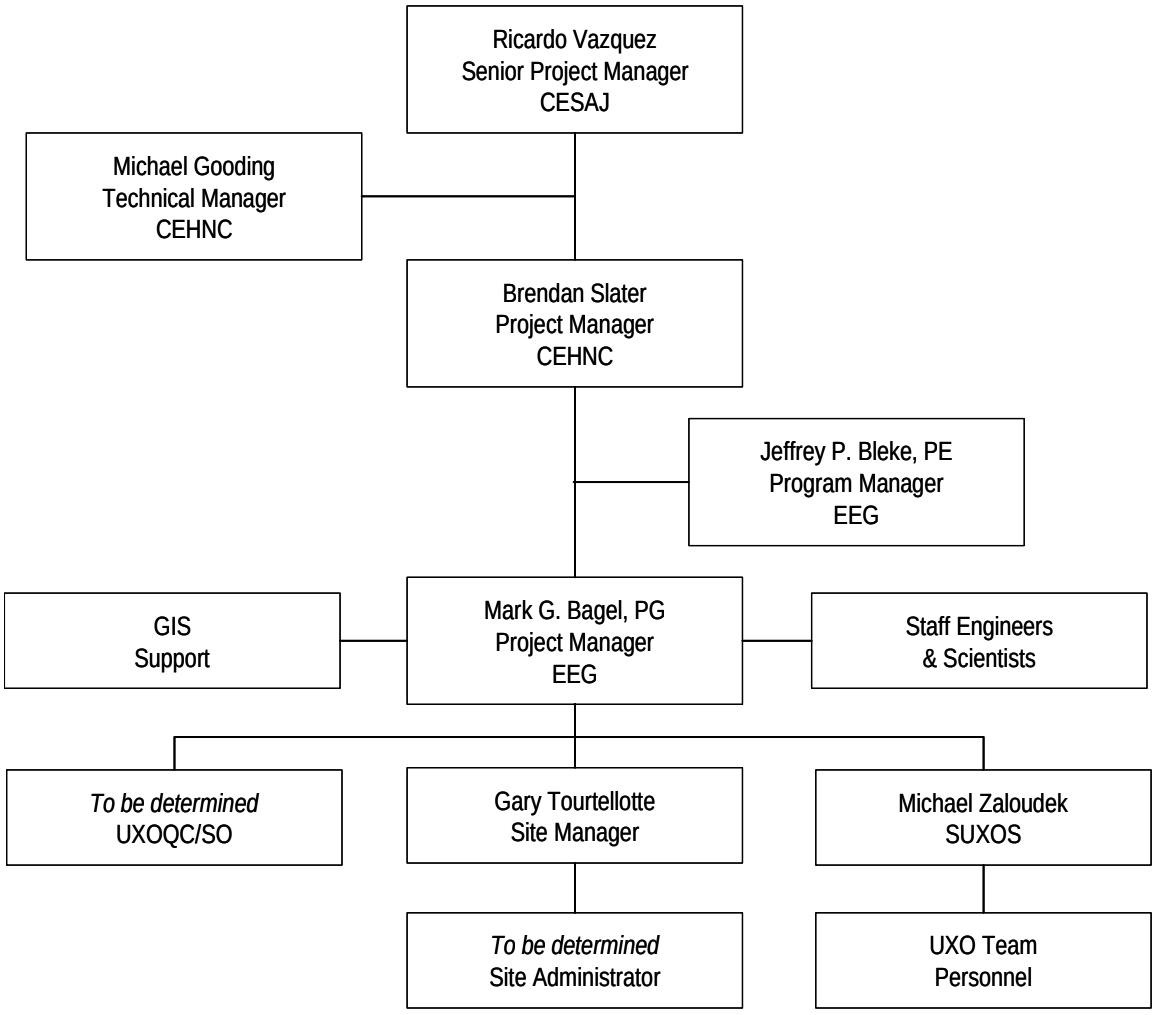
2.5 Procedures for Changed Site Conditions

In the event of changed site conditions, the contracting officer will be notified immediately in accordance with FAR Part 52.

2.6 Project Organization

The organizational chart in **Figure 2-1** depicts the organizations and key personnel involved in this project, and the subchapters following provide brief descriptions of their responsibilities.

Figure 2-1. Project Organization Chart



2.6.1 US Army Corps of Engineers, Jacksonville District

CESAJ is the life cycle project manager and is responsible for the overall project. CESAJ responsibilities include coordinating for site access, reviewing project work plans and documents, communicating with the news media and public, and coordinating with state and local regulatory agencies.

2.6.2 US Army Engineering and Support Center, Huntsville

CEHNC is the MEC Design Center for this project and has approval authority for project execution. CEHNC responsibilities include providing expertise for MEC-related activities, procuring MEC contractor services and directing the MEC contractor, controlling the budget and schedule, and coordinating document reviews. Michael Gooding is the technical manager for CEHNC, while Brendan Slater will be the project manager.

2.6.3 Ellis Environmental Group, LC

EEG is the prime contractor to CEHNC and will provide all engineering support and MPPEH investigation and removal services. EEG is responsible for performance of the activities detailed in the SOW (Appendix A), including developing the Work Plan, participating in community relations activities, and conducting the MPPEH ID and removal operations. EEG personnel will closely monitor the project budget and schedule. The following subchapters summarize the key personnel who will be required in the technical management of the project.

2.6.3.1 Program Manager

The program manager is Jeffrey P. Bleke. He is responsible for ensuring that contract requirements are being met on all task orders issued under this contract.

2.6.3.2 Project Manager

The project manager is Mark Bagel. He is responsible for all aspects of the project, including ensuring the quality of all products and services provided as part of this SOW, and ensuring that all deliverables satisfy project requirements and are conducted in accordance with the DIDs, specific portions of the Work Plan, and portions of the attached appendices. His responsibilities include:

- Project planning and execution

- Implementing all of the plans provided within the Work Plan
- Interfacing with QC and safety personnel as required in plans
- Coordinating improvements to the Quality Control Plan (QCP) plan based on suitability reviews
- Obtaining and communicating client requirements to the appropriate personnel
- Ensuring that qualified, skilled, and trained personnel and other resources are available for project execution
- Ensuring that products and services satisfy client requirements in all areas, including quality, safety, cost, schedule, performance, reliability, durability, accuracy, and maintainability
- Ensuring that personnel comply with applicable standards, regulations, specifications, and documentation procedures

2.6.3.3 UXO Quality Control / Safety Officer

The UXOQC/SO (to be determined) will be supplied by EEG and will be responsible for:

- Implementing the QCP and Accident Prevention Plan in the field
- Conducting QC and safety audits and meetings
- Preparing safety and QC reports

2.6.3.4 Senior UXO Supervisor

The SUXOS is Michael Zaloudek. He is responsible for the day-to-day on-site management during MPPEH ID and MEC removal operations and coordination with the EEG UXOQC/SO and project manager.

2.6.3.5 Staff Engineers and Scientists

Staff engineers and scientists are responsible for implementing, documenting, and maintaining aspects of this Work Plan, including but not limited to the Sampling and Analysis Plan (Appendix E) and the Geophysical Investigation Plan (Chapter 6).

2.6.3.6 UXO Team Personnel

2.6.3.6.01 UXO team composition will vary depending upon the task at hand. In all cases, the teams will be composed of no more than five UXO Technician I and/or UXO Technician II personnel. A UXO Technician III will be the team leader and immediate supervisor. Sweep

personnel may be used in place of a UXO Technician I where the operations involve the use of heavy equipment or tasks that will not require exposure to or handling of MEC items. EEG will have one UXO Technician II to perform MEC avoidance for the GPS survey team.

2.6.3.6.02 UXO team personnel (including a team leader, UXO Technician II, UXO Technician I, and sweep personnel) may be involved with brush clearance, survey and mapping escort, and heavy equipment operations. Only UXO personnel (team leaders, UXO Technician II, UXO Technician I) will perform MEC search, removal, and disposal operations.

- Escorting non-UXO personnel performing other tasks in the work area (e.g., survey personnel) to ensure MEC avoidance
- Operating electromagnetic devices
- Locating, marking, and recording the locations of all MC and MEC and ordnance-related materials found during the removal action
- Identifying and classifying MC and MEC
- Conducting explosive disposal procedures of MC and MEC
- Inspecting, removing, and segregating all scrap
- Performing MC and MEC operations as directed by the SUXOS

2.6.3.7 Site Manager

The site manager will be Gary Tourtellotte. He will be responsible for performing all database management, purchasing, supplies pickup, cost tracking, explosives tracking, data log book review and compilations, and GPS data collection and management. He will provide data to the project manager for weekly reports and assist the project team in site planning, provide weather updates, and provide a direct line of communication between the site and CEHNC project management and CESAJ community relations personnel. He will also be responsible for supervising environmental sampling at this site and proper completion of the chain-of-custody forms, the Chemical Quality Control Reports, and other sampling forms.

2.6.3.8 Site Administrator

The site administrator (to be determined) will be a part-time to full-time local hire with bilingual capabilities. He or she will know how to use Microsoft Word, Excel, and possibly Access software, and will assist with tracking costs, preparing bilingual documents, taking notes during public meetings, and providing assistance to the project manager and site manager as necessary.

2.7 Project Mobilization

The project manager and the SUXOS will require two weeks for logistics set-up at the site, including laying out initial grids, preparing the office, collecting supplies and equipment, and assessing site conditions. The project manager will remain on site until operations are smoothly underway and will spend at least three weeks with the site manager setting up for the field effort prior to mobilization.

2.7.1 Premobilization Activities

2.7.1.01 Prior to mobilization, the EEG project manager will submit the names and resumés (or UXO database ID numbers) to the CEHNC project manager for approval. EEG's project manager is responsible for ensuring that the experience levels of proposed project personnel meet the respective requirements of the positions that they will fill.

2.7.1.02 Responsible people of the field teams who will be handling explosives will be required to hold explosives permits. The EEG project manager will coordinate the acquisition of these permits for the field teams.

2.7.1.03 EEG must coordinate operations prior to mobilization and before demolition operations. Notification must be submitted to:

- United States Federal Aviation Administration
- USCG
- Municipality of Culebra
- Puerto Rico Police
- Culebra Municipal Police
- Culebra Fire Department
- Puerto Rico DNER
- Puerto Rico Environmental Quality Board (EQB)
- FWS
- National Marine Fisheries Service (NMFS)

2.7.1.04 All public announcements will be coordinated through the CESAJ Antilles office.

2.7.1.05 Culebra lacks many resources needed for this project, and shipping of equipment and supplies to the island is laborious. EEG will require use of the ferry and will schedule shipments to occur before and during mobilization.

2.7.1.06 Prior to full mobilization, EEG is required to acquire and set up one magazine in a magazine compound. This will be done in compliance with Puerto Rico regulations and DoD guidance document DoD 6055.9 STD. This task requires installing 10-foot-tall cyclone fencing with three strands of barbed wire across the top. The fence will be located no less than 6.5 feet from the magazine in any direction. EEG will coordinate inspection with the Puerto Rico police. This must be done prior to shipping explosives to the island. Figure B-2 in Appendix B shows the proposed location of the explosives magazines.

2.7.1.07 The magazine will meet the requirements specified in National Fire Protection Association (NFPA) 780 (Standard for the Installation of Lightning Protection Systems) and will have a grounding rod driven 5 feet into the ground 3 feet from the magazine, and will be connected to the magazine with at least a No. 6 ground strap. EEG will install a 10-foot-tall galvanized fence around the magazine with barbed wire on top. The fence will be located at least 6.5 feet from the magazine on all sides and will not require additional grounding.

2.7.1.08 The EEG project manager will be responsible for ordering explosive materials. Shipment of explosives will be closely coordinated with the beginning of mobilization to reduce potential temporary storage time.

2.7.1.09 Equipment storage may be set up at the office. To provide quick access for field teams, a used 20-foot (or larger) lockable shipping container may be acquired and set up prior to mobilization.

2.7.1.010 EEG will acquire a water pump, a water truck, and associated equipment to wet down the demolition area should demolition be conducted during a drought condition. The SUXOS will be responsible for determining whether the equipment should be employed.

2.7.1.011 EEG will open an account at the local bank to ensure that petty cash is available on the island to pay for incidental supplies and per diems.

2.7.1.012 Other preliminary activities include renting vehicles to transport individuals and/or equipment to the site, plus renting any equipment that may be required on site, including pumps, brush-clearing equipment, or other heavy equipment.

2.7.2 Field Office

2.7.2.01 EEG will establish a field office on Culebra. As office space is at a premium on this small island, the amount of space may be limited to a motel room. The field office will be the base of operations for EEG during field activities. The office will have Internet and telephone access to be used by both EEG and CEHNC personnel. A fax machine, copier, and printer may also be set up at the office. Mail or shipment of packages will be via United States Postal Service.

2.7.2.02 The field staff normally work four 10-hour days, Monday through Thursday (not to exceed 40 hours per week), except for EEG observed holidays. The work hours of the staff may be adjusted by the project manager (such as working five 8-hour days) to better support the field operations. Overtime will not be accrued without the concurrence of the CEHNC contracting officer.

2.8 Location Surveys and Mapping

Refer to Chapter 7 of this plan for detailed information.

2.9 Site Preparation

2.9.01 A licensed Puerto Rico Surveyor will establish and mark the boundaries and grid corners of each work site. The grid corners will be staked and marked with the corner ID. At least four control points consisting of steel rods or rebar will be placed at the investigation area boundaries. Small cays may have one control point instead. Where stakes cannot be driven due to rock, the rock will be painted and the grid corner ID will be noted on the surface. Prior to driving stakes, the area will be checked with electromagnetic detection equipment to ensure that no buried ordnance is in the area.

2.9.02 A vegetation and wetlands survey will be conducted by a qualified tropical botanist prior to the start of the MEC clearance operations. Protected vegetation will be identified and mapped. Additionally, all vegetation removal actions will be coordinated with the responsible environmental resources agencies prior to accomplishing any work in these areas. Protected plants and habitats will be located by GPS and mapped to identify those locations. Protected plants and habitats will remain untouched by site preparation operations prior to coordination with the responsible natural resources agencies. EEG will not perform MEC clearance operations in wetlands without prior coordination with the responsible natural resource agencies.

2.9.1 Tree Removal

2.9.1.01 EEG will identify all native trees that will not be disturbed as part the removal action. Invasive trees, such as mesquite, may be removed from the area. All vegetation removal will be coordinated with the responsible natural resources agencies. Trees and underbrush may be pruned to a height that will allow full area coverage by the geophysical equipment. We believe this height to be up to 12 inches from ground level to provide for unobstructed access to the ground surface.

2.9.1.02 Small trees (less than 2 inches in diameter) may have to be removed to accomplish the tasks in the SOW (Appendix A). EEG will remove larger trees only in cases where MEC is embedded in the tree or caught or suspended in the roots or branches, or to gain access to MEC, in which case the tree will be removed using chain saws. The tree will be sectioned, if necessary, to remove it from the immediate area so as not to interfere with the MEC removal action. If possible, the tree will be trimmed or pruned back instead of removed.

2.9.2 Brush Clearing

2.9.2.01 Selected brush removal, as required, will be conducted either manually or using mechanical equipment, as conditions dictate. Tractors and bulldozers will be used primarily on Cerro Balcon and will not be used on the FWS reserve unless first coordinated with FWS. Most vegetation removal will be conducted on the FWS reserve using hand tools (trimmers). All work on the cays will be closely coordinated through the FWS refuge manager. Brush may be pruned to a height that will allow full area coverage by the geophysical equipment.

2.9.2.02 Brush removal may be necessary to allow the surveyor to establish boundaries and allow UXO teams to complete surface surveys. Brush may be cut using a tractor and brush mower. Power tools such as chain saws, trimmers, and brush cutters may be used in addition to hand tools for this operation. EEG plans to trim and prune only the minimum amount of vegetation on the cays and Culebrita in order to allow our personnel access to the MEC removal areas and to permit full area coverage of the geophysical investigation. If necessary, EEG may trim grasses to no less than 6 inches in height

2.9.2.03 Cut brush will be removed only from the immediate work area so as to not interfere with the MEC removal action. The SUXOS will make a note in his Daily Operations Log of the total grid area cleared of vegetation each day.

2.9.3 Geophysical Equipment Testing

Geophysical techniques for testing are provided in Chapter 6 of this plan.

2.9.4 Surface Sweeps

2.9.4.01 Anomaly avoidance operations will be conducted in support of brush clearing during vegetation clearing on pathways to the magazine complex. The anomaly avoidance team will carefully mark an anomaly-free path to the magazine area.

2.9.4.02 The UXO team leader will record ID data, including item ID nomenclature, offset, and weight on a field copy of the Grid Sweep Log. As a final check to ensure that the item has been removed or destroyed, the UXO Technician III will visually check the item locations at the end of the day to confirm the item removal. The UXO team will dispose of any MEC or munitions debris items that are encountered during the surface clearance operations. All disposal operations will be performed under the direct supervision of the on-site SUXOS and the UXOQC/SO. The UXO team leader will be responsible for locating the item using mapping and/or GPS survey techniques before moving the item and/or its disposal. The disposal location will also be determined by GPS or approved mapping techniques. The Grid Sweep Log will also include a summary of munitions debris weight found on the grid or subgrid.

2.10 Procedures for Reporting and Disposition of Munitions and Explosives of Concern

2.10.1 Personnel Responsibilities

2.10.1.01 A UXO Technician III will provide a detailed account to the SUXOS of all MEC and munitions debris encountered. This account will include the quantity, type, depth, location, condition, and final disposition of all items located in each grid.

2.10.1.02 All data will be made available to the UXOQC/SO at the end of each work day. The UXOQC/SO will verify the accuracy and completeness of the data. Corrections or clarifications will be made and approved by the initiating UXO Technician III before the data is transferred to the site manager for entry into the site database.

2.10.1.03 A UXO Technician II will be responsible for locating each MEC item. Each item will be located using the proper GPS equipment. If the GPS constellation orientation or beacon is not

proper to obtain reliable data, the stakes for the MEC item will be left at the site until the location survey can be completed, or a map will be drawn on the Grid Sweep Log indicating where the item was located.

2.10.1.04 Boundary stakes will not be removed until the EEG UXOQC/SO has performed a QC inspection of the grid or subgrid and received approval from a CEHNC safety specialist after a QA completion check.

2.10.2 Safety Precautions

2.10.2.01 If more than one UXO team is working in an area, a minimum safe separation distance of 200 feet or the K50 distance for munitions with greatest fragmentation distance (MGFD) will be maintained between teams. All work will comply with EP 385-1-95a, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations. A copy of this document will be maintained on site.

2.10.2.02 Demolition operations will be conducted according to the standard safety practices and procedures outlined in TM 60A 1-1-31. MEC will be detonated only after positive ID. Demolition shots may be tamped to reduce the possibility of fire, sound attenuation, and fragment dispersal.

2.10.2.03 Demolition operations, if required, will normally take place at the end of each work day. The SUXOS is responsible for determining whether minimum safe conditions exist for conducting operations. If an event such as inclement weather prevents the destruction of any MEC, arrangements will be made to provide security for the site. EEG personnel will provide perimeter security during demolition operations.

2.10.2.04 The MSD for demolition operations is based upon the item being destroyed. Prior to demolition operations, the EEG UXOQC/SO will ensure that safe separation distances are established. Safety distances for intentional detonations are in Subchapter 4.2 of this Work Plan (**Table 4-1** includes the minimum safety distances for intentional detonations of the anticipated MGFD). If an unexpected item is found at the site having a net explosive weight (NEW) greater than the MGFD at the site, the EEG UXOQC/SO will be notified and he will establish a new safe separation distance based on that item. A change to the Explosives Safety Submission (ESS) changing the MGFD to the new item will be initiated and processed through ESS approval channels."

2.10.2.05 All detonations will be conducted according to TM 60A-1-1-31. Detonations will take place only after all unnecessary personnel have left the area and perimeter security has been posted.

2.10.2.06 All charges will be dual primed and initiated. Detonating cord trunk and branch lines will be used to link multiple shots. Jet perforators will be used in the event that venting for the purpose of investigating MPPEH is required.

2.10.2.07 All detonations will normally be tamped with sandbags to reduce the possibility of fire. The local fire department will be notified of pending disposal procedures, and EEG personnel will stand by should firefighting become necessary. Notification of detonations will be made to the applicable local authorities and any other organizations determined to be necessary.

2.10.2.08 During detonations, a designated project vehicle will remain in the safe area to provide emergency egress for the demolition team. The demolition team will be composed of only qualified UXO personnel identified by the SUXOS and will be under the direct supervision of a UXO Technician III who is the demolition supervisor. The demolition team members are the only personnel authorized to use explosives on site.

2.10.2.09 The demolition team, SUXOS, UXOQC/SO, and on-site CEHNC safety specialist are the only personnel other than the demolition team members allowed in the area where charges are being assembled and demolition operations conducted. The demolition team will test the systems and set up the shots in accordance with this Work Plan. The UXOQC/SO or the SUXOS will verify the set-up after the explosives are set. The CEHNC safety specialist may inspect any stage of the operation at his discretion.

2.10.2.010 All demolition materials will be accounted for by the demolition supervisor and reported to the SUXOS. Only the amount of demolition material required to complete each day's operation will be withdrawn from the magazines and transported to the site.

2.10.2.011 After each detonation, the detonation points will be inspected by the UXOQC/SO and the SUXOS to ensure that a misfire, low order, or kick-out has not occurred. The area where demolition operations are being conducted will remain secured until the SUXOS or UXOQC/SO gives the "all clear."

2.10.3 Identification of MEC

2.10.3.01 Every effort will be made to identify and evaluate a suspect MEC item. The UXO team leader will be responsible for the preliminary ID of all MEC. EEG will provide a series of ordnance documents that will be available on site to help identify and evaluate the MEC items found. These will include ordnance data books, Ordata software, and access via the Internet to the Ordata online "International Deminer's Guide to UXO Identification, Recovery, and Disposal." Before any action is performed on an ordnance item, all fuzing will be definitively identified, including fuze type by function and condition (armed or unarmed) and the physical state or condition of the fuze.

2.10.3.02 The UXOQC/SO will review and verify correct and proper ID for all recovered MEC, MPPEH, or MC.

2.10.4 Transportation of Explosives

2.10.4.01 On-site transportation of explosives from the magazines to the demolition location(s) will be by designated vehicle, following the requirements set forth in 49 CFR and DoD 6055.9 STD. Only UXO-qualified personnel may transport explosives. These individuals must have a valid driver's license and will be instructed on transporting explosives, inspecting and operating vehicles, and emergency response.

2.10.4.02 Vehicles used to transport explosives will have substantially constructed bodies, with no sparking metal exposed in the cargo space, and be equipped with suitable sides and tailgates. Explosives will not be piled to extend over the sides or the end of the vehicle.

2.10.4.03 Vehicles containing explosives will be maintained in good condition and operated at a safe speed and in accordance with all safe operating practices. Vehicles containing explosives will be posted with proper warning signs.

2.10.4.04 Materials or supplies will not be placed on or in the vehicle cargo space containing explosives, detonating cord, or detonators, except for safety fuse and properly secured non-sparking equipment used expressly in the handling of such explosives or detonating cord. Explosives and blasting caps will be transported in separate vehicles. Explosives and blasting caps will be promptly transported without delays in transit. EEG will use day boxes for the transport of explosives. Explosives and blasting caps will be transported at times and over routes that limit exposure to a minimum number of people.

2.10.4.05 Only the necessary attendants will ride on or in vehicles containing explosives or blasting caps. When a vehicle containing explosives or detonators is parked, the brakes will be set, the motor will be shut off, and the vehicle will be blocked securely against rolling. After the vehicle is secured, the blasting cap box and the containers with the explosives will be removed from the cargo area of the vehicle and placed on the ground before any explosives or blasting caps are removed from the containers.

2.10.4.06 The motor vehicle used for transporting explosives will have the following minimum safety equipment:

- Fire extinguishers (two 10A:60B:C dry chemical extinguishers)
- Flame-retardant cover, or metal containers such as Institute of Makers of Explosives (IME) boxes or other suitable metal containers with latching lids and appropriate padding
- Non-metallic bed-liner such as sand bags, dunnage, or wooden box

2.10.5 Safe Holding Areas

Detonations of explosives will be conducted each day that an item is found. A safe holding area therefore will not be required.

2.10.6 Operations in Populated or Sensitive Areas

2.10.6.01 The OOUs to be investigated during implementation of this task order are outside of populated areas; however, at times the transport of explosives may encroach on populated areas. EEG will coordinate transport of explosives through populated areas with the local police, and all vehicles will be properly placarded and all safety precautions will be followed in accordance with this Work Plan.

2.10.6.02 To reduce population exposure to transported explosives, EEG will work with EQB and other responsible agencies to locate the explosives and transportation routes in a manner that will provide the least amount of transport through populated areas. Use of the DNER docks will enable EEG to access the boats for transport of explosives without going through the town.

2.10.6.03 Operations may be conducted in environmentally sensitive areas where sea birds and turtles may nest during certain times of the year. EEG will closely coordinate with the responsible environmental resources agencies to ensure that MEC removal operations will not be conducted in those areas during the nesting seasons. As it is impossible to predict exact dates of nesting

behaviors, coordination with the responsible environmental resources agencies will be frequent during the removal action, and schedules will remain flexible to ensure protection of protected sea birds and turtles. Preliminary exclusion dates are provided in the Environmental Protection Plan (Chapter 11).

2.10.6.04 EEG will perform removal operations in a manner to provide maximum safety for the public. To protect the public from exposure to an unintentional detonation during work operations, EEG will maintain an exclusion zone (a distance from work operations where people cannot safely enter) which is equivalent to the maximum fragmentation distance in **Table 4-1** of this Work Plan. EEG will stop work if private citizens or non-essential personnel enter the exclusion zone. During intentional detonations, EEG will be using sandbags over the explosives to prevent fragments from exceeding a distance of 200 feet. This method of blast mitigation has been extensively studied by CEHNC personnel and has been found to be extremely effective for reducing the distance that fragments will travel.

2.10.6.05 EEG will maintain an exclusion zone that will be equivalent to the maximum safety distance identified in **Table 4-1** for work on each of the cays. EEG personnel will be located in boats and will use marine radios and bullhorns to maintain the border of the exclusion zone. If a private boat enters the exclusion zone, EEG personnel will stop work until the boat leaves the area. EEG will coordinate all work operations with local dive shops, boat rental companies, fishermen, and USCG to ensure cooperation on where and when we perform removal operations in an effort to reduce potential effects of downtime.

2.10.6.06 EEG will not be conducting explosive operations below the high-water line on any of the cays; therefore, the blast overpressure will have minimal effect on marine life. Although the potential exists for large bomb detonations, the metal mass that may enter the water will be insignificant over the entire blast area. It should be noted that during the EE/CA and site visits conducted by USACE, no large MEC items were observed at the surface of any of the cays.

2.10.6.07 EEG plans to conduct MEC demolition operations each day that an item of MEC is found. Under most conditions, the MEC item will not remain in place for more than 24 hours after detection; however, if unusual conditions occur (e.g., climate conditions not appropriate for detonation of explosives), EEG will provide security for the item.

2.11 Demolition and Post-Demolition Operations

2.11.1 Responsibilities

2.11.1.1 Senior UXO Supervisor

The SUXOS will be responsible for ensuring that adequate safety and housekeeping measures are taken during all phases of site operation, including demolition activities, and shall visit site demolition locations as deemed necessary to ensure that demolition operations are carried out in a safe, clean, efficient, and economical manner. The SUXOS will complete a Daily Operations Log, which will include demolition data.

2.11.1.2 Demolition Supervisor

Prior to initiation of demolition operations, the SUXOS shall designate one of the team leaders to be the demolition supervisor, who will be responsible for supervising all demolition operations within the area. The demolition activities shall be conducted under the direct control of the demolition supervisor, and the demolition supervisor shall be responsible for training all on-site UXO personnel regarding the nature of the materials handled, the hazards involved, and the precautions necessary. The demolition supervisor will also ensure that the MEC Accountability Log, Demolition Shot Log, Explosives Consumption Certificate, and Explosives Accountability Record (also known as the magazine data card) are properly filled out and accurately depict the demolition events and demolition material consumption for each day's operations. The demolition supervisor shall be present during all demolition operations.

2.11.1.3 UXO Quality Control / Safety Officer

2.11.1.3.01 The UXOQC/SO for the site is responsible for ensuring that all demolition operations are conducted in a safe manner, and is required to be present during all MEC demolition operations. The only exception to this rule is when various types of MEC investigation and remediation operations are being conducted concurrently at multiple sites during periods of continuous demolition operations throughout the day. In such circumstances, a demolition team safety officer will be designated. This individual will report to the UXOQC/SO and assume the UXOQC/SO's responsibilities at the demolition range.

2.11.1.3.02 The UXOQC/SO is also responsible for ensuring the completeness of demolition operations and for weekly inspecting the MEC Accountability Logs, Demolition Shot Logs,

Explosives Consumption Certificates, and Explosives Accountability Records. The UXOQC/SO, assisted by demolition team personnel, will inspect each demolition area and an area of up to 250 feet in radius after each demolition shot to ensure there are no kick-outs, hazardous MEC components, or other hazardous items. In addition, the area will be checked with an electromagnetic device, and large metal fragments and any hazardous debris will be removed from the area. Any MEC discovered during the QC check will be properly stored for destruction at a later date. Extreme caution must be exercised when handling MEC that has been exposed to the forces of detonation.

2.11.2 Fire Prevention for Disposal Operations

2.11.2.01 Due to the high fire potential season anticipated at the site, the following procedures will be adhered to on each disposal shot conducted at the site. No fire shall be fought if the fire involves ammunition or explosives, or is supplying heat to ammunition or explosives, or is so large that it cannot be extinguished with the equipment at hand.

- Prior to detonation of items less than 155 mm in diameter, EEG will use sandbags to tamp the blast and mitigate the possible fire hazard. Additionally, the area will be watered down prior to detonations.
- Prior to detonation of items greater than 155 mm in diameter, EEG will tamp using loose fill in accordance with the Buried Explosion Module (BEM) in TP 16 to determine the effective soil thickness.
- The local fire department, police, and emergency management personnel will be notified prior to all detonations. If possible, the fire department should be on scene during demolition operations.
- MEC that is moved for disposal will be taken to a location that will provide the most protection from fires and provide the easiest access for firefighting vehicles if required.
- For MEC that cannot be moved, measures will be taken to carefully plan (prior to detonating shots) fire-suppression accesses and procedures. All disposal and safety personnel will be fully briefed on fire-suppression procedures.
- Immediately after detonation, the demolition supervisor will report status of the disposal site and presence or absence of fires.
- If fire or smoke in the vegetation surrounding the site is present, the demolition team will proceed immediately to the site with field fire-suppression equipment and attempt to suppress any fires present.

- If a fire becomes uncontrollable, emergency notifications to local fire agencies will be made and all field workers will stand by to assist as necessary.

2.11.2.02 The fire prevention goals include:

- Planning effectively for all potential fire suppression obstacles
- Effectively mitigating the disposal shot and surrounding vegetation with water
- Ensuring that prevailing winds will not take potential smoke towards populated areas
- Ensuring that adequate fire suppression equipment is on site
- Maintaining vigilant communications with the local fire department during all disposal operations

2.11.2.03 A centrifugal pump will be used to provide water to the site to wet down the vegetation in the detonation area and reduce the potential of fire. The pump will have a 2-inch or 4-inch diameter intake hose. The pump will be capable of pumping 200 to 400 gallons per minute and it is estimated that the pumping will take less than 10 minutes to fully saturate the 50-foot radius around the detonation point. At Cerro Balcon, the pump will be used in conjunction with a water truck. At Culebrita and the cays, the water will be pumped from the shallow beach area to the site. To reduce the potential for entrainment of little fish into the pump, the end of the intake hose will be fitted with a screen.

2.11.2.04 In lieu of pumped water, a water containment system may be used to mitigate fragmentation from blast effects as detailed in HNC-ED-CS-S-00-3, “Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions,” USACE, September 2000.

2.11.3 General Requirements

2.11.3.01 Items determined to be unacceptable to move will be blown in place. All unnecessary personnel will be removed from the area and road guards will be posted, the required local authorities will be notified, and protective works will be instituted prior to demolition. The demolition supervisor will check the area and perform proper mitigation of potential hazards to public property and vegetation using tamping and other engineering controls. These items may be consolidated with items deemed acceptable to move by CEHNC.

2.11.3.02 When destroying multiple items at once, “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites” must be used. A copy of this document will be made

available on site for the demolition supervisor. EEG will determine MSDs for all demolition operations in accordance with DDESB TP 16. Prior to detonation, all personnel will withdraw beyond the MSD.

2.11.3.03 EEG will conduct an evacuation of all houses within the MSD. At the discretion of CEHNC, arrangements may be made for local temporary accommodations for displaced residents. Evacuees will be permitted to re-enter the area only after the demolition point has been inspected and the "all clear" has been given by the demolition supervisor.

2.11.3.04 Prevailing weather condition information will be obtained from the United States Weather Service and the data logged in the Demolition Shot Log before each shot or round of shots.

2.11.3.05 All shots shall be dual primed.

2.11.3.06 A minimum of 30 seconds will be maintained between each detonation.

2.11.3.07 After each detonation and at the end of each day's operations, munitions debris and related items shall be recovered from the demolition site. Per the SOW, all munitions debris will be disposed of in accordance with munitions debris procedures and all applicable environmental regulations. All collected munitions debris will be 100 percent inspected for absence of explosive materials by UXO personnel and 100 percent re-inspected and certified by the SUXOS before it is turned over to a scrap dealer.

2.11.3.08 When demolition site operations are performed in accordance with the conditions of this contract, the demolition site should not present a noise problem to the surrounding community; however, if a noise complaint is received, the name, address, and telephone number of the complainant should be recorded and reported to the SUXOS, who in turn will report it to the EEG site manager.

2.11.3.09 Before and after each shot, the Demolition Shot Log is to be filled out by the demolition supervisor with all applicable information. This record will be kept with the MEC Accountability Log and reflect each shot.

2.11.4 Environmental Considerations

2.11.4.01 EEG will conduct environmental surveys in the vicinity of the areas to be investigated to identify and map sensitive environmental species. Those areas will be protected from the impact of detonations through the use of barricades, as necessary, based on the size of the areas and the proximity to detonations.

2.11.4.02 The environmental surveys will include a wetlands survey on Isla Culebrita and a protected species and habitat survey on Isla Culebrita, the cays, and Cerro Balcon.

2.11.4.03 During the environmental surveys to the cays, EEG will investigate the routes of access to the cays in order to find the best routes of access that will create the least amount of impact to the marine life in the cays. EEG will conduct all operations in a manner that will provide for the least amount of impact to the marine ecosystems.

2.11.4.04 The results of the surveys will be included in the Work Plan Addendum, which will be reviewed before start of work on the cays.

2.11.4.1 Extent of Impacts from Individual Shots

2.11.4.1.01 The major impacts from individual shots will be a result of the heat, blast pressure, and fragmentation As stated previously, the effects of the heat of the blast will be mitigated by wetting of the surrounding area, and the heat, blast pressure, and fragmentation of the blast will be mitigated using sandbags to tamp shots involving items up to a 155 mm projectile. EEG will tamp items larger than 155 mm using loose fill in accordance with the Buried Explosion Module (BEM) in TP 16.

2.11.4.1.02 As provided in DDESB TP 16: “The nose and tail sections of most munitions will break into a small number of massive fragments moving at velocities up to about 3,000 feet/second (ft/s). The cylindrical body will fracture into many smaller fragments traveling at speeds of up to 8,200 ft/s.” The maximum size of the fragments will be dependent on the design of the individual MEC items. The maximum calculated fragment size for each type of item is included in Appendix G of this Work Plan. It does not include fragments from fuze wells, base plates, lugs, strongbacks, etc. which are frequently larger and travel further (although there are fewer of them). It is suspected that the fragments will vary in size from 0.0006 pound for the 20 mm rounds to 0.9 pound for the 1,000-pound bomb. These metal fragments will be widely dispersed in the area of the site, with higher concentrations in the vicinity of the site.

2.11.4.1.03 The maximum fragmentation distance for the items expected to be found are shown in **Table 4-1** and Appendix G. If items are found during the removal action that are not expected, the fragmentation distance will be calculated for those items. If that distance is greater than the separation distance currently being used, the new distance will become the new separation distance and a change will be initiated to the ESS.

2.11.4.1.04 Any detonation on or below the ground surface will create a crater; therefore, all detonations will result in soil ejecta.

2.11.4.1.05 For humans, the blast can rupture lungs and ears; therefore, non-essential personnel will be kept out of the work area during removal operations. The MSD is the maximum of the maximum fragmentation distance, the blast overpressure distance, or 200 feet. Non-essential personnel are not allowed inside the MSD while work is being performed.

2.11.4.1.06 Minimal impact is possible to the land and marine environments as a result of individual shots. EEG will use the protective actions presented in Subchapter 2.11.4.3 to minimize the impacts of the explosive detonations of MEC.

2.11.4.1.07 The removal action will be conducted inland from the high-water line; therefore, the effects of individual shots on the surrounding reefs will be minimal. Where possible, items that can be safely moved will be moved inland to reduce the impact of shrapnel and debris from the shot into the marine environment.

2.11.4.2 Extent of Impacts for Consolidated Shots

2.11.4.2.01 Tests indicate that the fragmentation characteristics of multiple rounds that are detonated either simultaneously or sympathetically are different than those of single rounds. Large fragments are more numerous for detonations of multiple rounds. Also, the velocity of the leading fragments has been observed to be as much as twice the value for a single item. Therefore, any method used to determine fragment distances produced by multiple round detonations must account for these different fragmentation characteristics.

2.11.4.2.02 The location of consolidated shots will be as far away as possible from the shoreline, critical habitats, and protected species to minimize the impact to the land and marine environments as a result of individual shots. To aid to this end, EEG will use the protective actions presented in Subchapter 2.11.4.3 to minimize the impacts of the explosive detonations of MEC. Appropriate measures as provided in Subchapter 2.11.4.1 will also be conducted.

2.11.4.2.03 The effect of detonating stacks of munitions is to increase the fragment initial velocity by as much as a factor of 2 and to increase the fragment mass by as much as 50 percent. Results of experiments have shown that (per DDESB TP 16) "when detonations involve stacks of munitions, the maximum horizontal range must be increased by 33% to account for interaction effects."

2.11.4.2.04 The maximum fragmentation characteristics shall be computed in accordance with DDESB TP 16. The maximum fragment range shall be computed using these fragmentation characteristics with a trajectory analysis such as the computer software TRAJ. The maximum fragment range has been calculated for all items expected to be found at the site and the MSD for each area established based on these. Consolidated shots will be done in accordance with "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites." In accordance with these procedures, the MSD for consolidated shots will not exceed the MSD for the munition with the greatest fragmentation distance (MGFD).

2.11.4.3 Minimization of Impacts

2.11.4.3.01 EEG will make a reasonable attempt to minimize the impacts of the explosive detonations to the environment including sensitive habitats and endangered species. EEG will create a 5-foot buffer around areas containing sensitive species that will not be investigated without approval from CEHNC and coordination with the responsible regulatory agencies. A barricade will be constructed of sandbags to protect the endangered species from fragments of metal and explosives emitted from the shot in areas where endangered plant species or habitats lie in close proximity to the detonations (less than 15 feet). The barricade will be of sufficient height (2 to 4 feet tall) to protect the main part of the vegetation from the blast and direct-line fragmentation.

2.11.4.3.02 EEG will wet down the vegetation prior to performing demolition operations. These steps are described in detail earlier in this section of the Work Plan.

2.11.4.3.03 EEG will tamp shots where items are less than or equal to a 155mm projectile. Tamping will be conducted using sandbags. The thickness of the sandbags is computed and presented in the tables in Appendix G. If items are found that are more hazardous than those included in Appendix G, EEG will contact CEHNC for guidance. Items larger than 155 mm will be covered by loose soil in accordance with TP 16. EEG personnel will be using the BEM model to calculate the maximum fragmentation distance for these items.

2.11.4.3.04 Prior to work, the UXO technicians will receive an orientation concerning expected endangered species at each site, their locations, and protective measures.

2.11.4.3.05 The locations of all items found will be located by GPS coordinates and the condition of each item noted, including signs of damage to the item that may allow leakage of hazardous constituents into the soil.

2.11.4.3.06 EEG will conduct soil sampling both before and after detonations have been conducted. The soil sampling protocol is provided in Appendix E. The results will be compared with the EPA Region 9 Preliminary Remediation Goals. If exceedances of criteria are found, EEG will confer with the CEHNC contracting officer to immediately resample the area to find the extent of the contamination and, if necessary, conduct background sampling for target constituents.

2.11.5 Non-Electrical Demolition Procedures

2.11.5.1 Safety Precautions

2.11.5.1.01 Handle non-electric blasting caps by their open ends, except during attachment to safety fuse and/or the detonating cord.

2.11.5.1.02 Do not confuse the detonating cord with the safety fuse.

2.11.5.1.03 Do not insert anything except the safety fuse or detonating cord into the blasting cap.

2.11.5.1.04 Do not crimp blasting caps by any means except a cap crimper designed for that purpose, and ensure that the fuse-cutting section of the crimper is not used to crimp the cap.

2.11.5.1.05 Handle primed safety fuses with care to avoid contact between blasting caps or between the caps and other hard objects.

2.11.5.1.06 Secure the safety fuse after priming the charge. Do not allow the safety fuse to coil up and contact itself after being ignited.

2.11.5.2 Preparation Procedures

2.11.5.2.01 SUXOS will establish demolition operation times and notify a CEHNC safety specialist and demolition supervisor of the time to start demolition operations.

2.11.5.2.02 The demolition supervisor will conduct a safety and operational briefing for the personnel involved in the operation. At minimum, the briefing will cover items to be disposed of plus safety precautions, task assignments, safe area, safety equipment location, emergency procedures, and plan of action.

2.11.5.2.03 Area guards will be posted.

2.11.5.2.04 Demolition explosives will be brought to the demolition site.

2.11.5.2.05 Unnecessary personnel will withdraw to a safe area.

2.11.5.3 Demolition Set-Up Procedures

2.11.5.3.01 Position and secure donor charge, detonating cord, and perforator/binary explosive to the item to be disposed of.

2.11.5.3.02 Cut and discard at least a 6-inch length from the free end of the safety fuse to be used, which will prevent a misfire caused by moisture absorption.

2.11.5.3.03 Cut off a 36-inch length of safety fuse to check the burning rate. Perform this at least 50 feet downwind from any explosives. Note the time for the fuse to burn. Compute the rate of burn per foot.

2.11.5.3.04 Cut the fuse long enough (but never less than 6 feet) so that the person initiating the charge has enough time, while walking at a normal pace, to reach a safe distance before charge detonation. Attach a fuse igniter to one end of the safety fuse.

2.11.5.3.05 Remove a blasting cap from the container, inspect the open end of the cap, and ensure that no foreign matter is in the cap. If any foreign matter is in the cap, turn the cap upside down and let the matter fall out. If this fails, reject the cap.

2.11.5.3.06 Insert the safety fuse into the open end of the blasting cap. Gently seat the blasting cap firmly against the safety fuse.

2.11.5.3.07 Crimp the cap in place.

2.11.5.3.08 Obtain clearance to prime the donor charge.

2.11.5.3.09 Prime the donor charge, unroll, and secure the safety fuse to prevent recoil after initiation.

2.11.5.3.010 The demolition supervisor will ensure that the area is clear and that all personnel are accounted for, and will obtain clearance from the SUXOS to initiate the charge.

2.11.5.3.011 Upon receiving clearance to initiate the charge, the demolition supervisor will loudly yell, three times: “Fire in the hole!” Team members will function the fuse igniters, note the time, and proceed to the safe area.

2.11.6 Electrical Demolition

2.11.6.1 Electromagnetic Radiation

2.11.6.1.01 Electromagnetic radiation (EMR) sources are not expected in the vicinity of any removal action work site designated in this task order; however, before application of electrical demolition procedures, an EMR survey will be conducted by the UXOQC/SO to determine if any transmitting antennas of radio, radar, or other electromagnetic-generating devices are located in the vicinity. The UXOQC/SO will drive the roads near the site to identify each potential source that may produce strong enough EMR to affect the demolition operations.

2.11.6.1.02 Radio frequency EMR consists of waves of electrical energy. These waves are radiated in a line of sight from the antennas of electronic devices that transmit radio, radar, television, or other communication, including cellular telephones, or other communication or navigation radio frequency signals. The factors to be considered when evaluating the degree of hazard that the radio frequency EMR energy represents are the strength of the field (its power), the frequencies transmitted, the distance from the transmitter antenna to the ordnance, and the amount or type of protection available.

2.11.6.2 Blasting Caps and Safe Distances from EMR Source

Every wire, including a blasting cap lead, by virtue of its length and configuration, is tuned or receptive to a specific frequency. Stretched out, the leads act as a dipole antenna; coiled, they can act as a closed loop antenna. No lead wire configuration is therefore guaranteed to be safe. Electric blasting caps should be kept in a sealed metal container until ready for use. **Table 2-2** provides safety distances for electrical blasting operations.

Table 2-2. Minimum Safe Distances Between Mobile Radio Frequency Transmitters and Electric Blasting Operations

Transmitter Power (Watts)	Safety Distance (in feet)				
	Medium Frequency (MF) To 3.4 MHz Industrial	High Frequency (HF) 28–29.7 MHz Amateur	Very High Frequency (VHF) 35–36 MHz 42–44 MHz 50–64 MHz	Very High Frequency (VHF) 144–148 MHz 150.8–161.6 MHz	Ultra High Frequency (UHF) 450–460 MHz Cellular car phones above 800 MHz
5[1]	30	70	60	20	10
10	40	100	80	30	20
50	90	230	180	70	40
100	120	320	260	100	60
180[2]	170	430	350	130	80
250	200	500	410	160	90
500[3]	280	710	580	220	120
600[4]	300	780	640	240	140
1,000[5]	400	1,010	820	310	180
10,000[6]	1,240	3,200	2,600	990	560

Notes

MHz = megahertz

1 = Citizens band radio (Walkie-Talkie) (26.96 to 27.41 MHz) – minimum safe distance, 5 feet. Double sideband, 4 watts maximum transmitter power – handheld, 5 feet; vehicle-mounted, 65 feet. Single sideband, 12 watts peak envelope power – handheld, 20 feet; vehicle-mounted, 110 feet.

2 = Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed-station units in UHF (450 to 460 MHz range).

3 = Maximum power for major VHF 2-way mobile and fixed-station units is 35 to 44 MHz range.

4 = Maximum power for 2-way fixed-station units in VHF (150.8 to 161.6 MHz range).

5 = Maximum power for amateur radio mobile units.

6 = Maximum power for some base stations in 42 to 44 MHz band and 1.6 to 1.8 MHz band.

2.11.6.3 Lightning, Electric Power Lines, and Static Electricity

2.11.6.3.01 Lightning is a hazard to both non-electric and electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap and other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at remote locations, may cause extremely high local earth currents, which may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduit. The only safe procedure is to suspend all blasting activities during an electrical storm and when one is

impending. All blasting activities will be suspended when lightning-thunder storms are within 5 miles of the project site. Electrical firing will not be performed within 155 meters of energized power transmission lines. When it is necessary to conduct disposal operations at distances closer than 155 meters to electric power lines, non-electric firing systems will be used or the power lines de-energized.

2.11.6.3.02 Many electric blasting caps have been detonated because they grounded static electricity that was in the air. Static electricity is produced by various causes, among them: dust storms, which have caused a large number of detonations; snow storms, less dangerous but known to have caused premature explosions; and escaping steam, known to have charged the air and detonated electric caps. Enough static electricity to detonate electric caps also can be generated by such sources as moving belts and revolving automobile (truck) tires. Static electricity is an increased hazard when operating in an extremely cold climate or area of low humidity.

2.11.7 Electrical Detonation Procedures

An electric firing system is one in which electricity is used to fire the primary initiating element. An electric impulse supplied from a power source, usually an electric blasting machine, travels through the firing wire and cap lead wires to fire an electric blasting cap. The chief components of the system are the electric blasting cap/electric squibs, firing wire, and the blasting machine. The preparation of the explosive charge for detonation by electrical means is called electric priming.

2.11.7.1 Safety Precautions

2.11.7.1.01 Personnel working with electric blasting caps or other electro-explosive devices will not wear static-producing clothing such as nylon, silk, or synthetic fiber.

2.11.7.1.02 Before making connection with the electric blasting cap, the firing circuit will be continuity tested.

2.11.7.1.03 Electric blasting caps will be connected to the firing circuit before connection to the main initiation charge.

2.11.7.1.04 Electric blasting caps of different manufacturers or types will not be used in the same system.

2.11.7.1.05 The shunt will not be removed from the wires until the individual performing the operation has been grounded.

2.11.7.1.06 Electric blasting caps will be tested for continuity with a galvanometer at least 50 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.

2.11.7.1.07 Do not pull on electrical lead wires of electric blasting caps, detonators, or other electro-explosive devices; a detonation may occur.

2.11.7.1.08 Unroll the legs so that the cap is as far as possible and pointing away from the operator.

2.11.7.1.09 Place the blasting cap in a hole or behind a barricade before removing the shunt and testing for continuity. Make sure the cap does not point toward other personnel or explosives.

2.11.7.1.010 Use only authorized and serviceable testing equipment.

2.11.7.1.011 Do not connect the blasting machine to the firing wires until all pre-firing tests have been completed and until ready in all respects to fire the charge.

2.11.7.1.012 Do not hold the blasting cap directly in the hand when uncoiling leads. Hold the wires approximately 6 inches from the cap. This will minimize injury should the cap explode. The lead wires should be straightened by hand and not thrown, waved, or snapped to loosen the coils.

2.11.7.1.013 Do not remove the shunt from the lead wires of blasting caps except for testing for continuity or actual connection into the firing circuit. The individual removing the shunts should ground himself prior to this operation to prevent accumulated static electricity from firing the blasting cap.

2.11.7.1.014 Keep both ends of the firing wires shorted or twisted together except for testing or firing. Do not connect the blasting caps to the firing circuit unless the power end of the firing circuit lead is shorted.

2.11.7.1.015 Keep all parts of the firing circuit insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.

2.11.7.2 Procedures

2.11.7.2.01 Prepare and place all explosive charges.

2.11.7.2.02 After locating a firing position a safe distance away from the charges, lay out the firing wire. (Do not drag firing wire over sand, which may generate a static charge.)

2.11.7.2.03 Test the firing wire by using a blasting galvanometer or test set, after making sure that the testing equipment is functional and after the firing wire has been unreeled. Ensure that the ends are twisted together when not testing.

2.11.7.2.04 Separate firing wire conductors at both ends, and touch those at one end of the galvanometer/test set posts. The needle should not move or the lamp glow; if either occurs, the firing wire has a short circuit.

2.11.7.2.05 Twist the wires together at one end and touch those at the other end to the galvanometer/test set posts. This should cause a wide deflection of the needle or cause the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance, which may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections.

2.11.7.2.06 Ground yourself. Test the blasting caps by removing the short circuit shunt. Touch one end of the cap lead wire to one post and other cap lead wire to other post. If galvanometer's needle deflects slightly less than it did when the instrument was tested, the blasting cap is satisfactory; if not, the cap is defective and should not be used. Ensure that the cap lead wires are twisted together when not testing.

2.11.7.2.07 Connect the blasting cap leads to the firing circuit and insert the blasting caps into the main charge or attach to detonating cord leads if the main charge is buried or tamped.

2.11.7.2.08 Depart to the firing point.

2.11.7.2.09 Take cover.

2.11.7.2.010 Obtain a head count.

2.11.7.2.011 Ground yourself. Test the entire circuit after inserting caps into the charges and connecting the charges with the firing wires and moving to firing position. Touch the free ends of

the firing wire to test the instrument posts. This should cause a wide deflection of needle or cause the lamp to glow. If the firing circuit is defective, shunt the wire. Then go down range and recheck the circuits. If the splice is found to be defective, replace the wires. If the cap is found to be defective, replace it. Retest the entire circuit to make sure that all breaks have been located before attempting to fire.

2.11.7.2.012 Test the blasting machine before attaching the firing wire. Untwist the ends of the firing wire and fasten them to the posts of the blasting machine.

2.11.7.2.013 Return to the firing point.

2.11.7.2.014 Yell, three times: “Fire in the hole!” Initiate the charge.

2.11.7.2.015 Wait 5 minutes after the detonation.

2.11.7.2.016 Remain in the designated safe area until the SUXOS announces, “All clear.”

2.11.8 Electrical Testing and Detonation Procedures for Rothenbuhler Remote Firing Device

2.11.8.01 The Rothenbuhler 1670 remote firing device system is comprised of one control unit and one to eight remote units, and is used to initiate non-electric shock tube as well as standard electric blasting caps. The system can be used repeatedly throughout an operation and will give an “answer back” or confirmed status of all or any one of the remotes. The remotes can be held in the standby (not armed) mode for 12+ hours and still maintain the energy to initiate the shot. The 1670 remote firing device includes redundant internal safety circuitry and a timed automatic disarming feature. If the remotes do not receive a properly addressed (encoded) firing signal within 2 minutes of being armed, the system will automatically return to the disarmed state. This allows for absolute control of detonation timing.

2.11.8.1 Testing the Remote Firing Device

2.11.8.1.01 This test procedure must be conducted in an area that is at least 100 feet from the nearest electric detonators or wires connected to electric detonators.

2.11.8.1.02 Position the controller and remote units at least 5 feet (1.5 meters) apart, in a position where all units can be observed while testing.

2.11.8.1.03 Install the antennas on the controller and the remote units.

2.11.8.1.04 On each remote, insert the enable keys and turn the POWER switch to the ON position. Observe that the READY, ARMED, and POWER lights blink briefly on power-up. The yellow light next to the enable key should blink continuously to show that the key is installed. The POWER light should remain on steady.

2.11.8.1.05 On each remote unit, place the SELECT switch to the ELECTRIC DETONATOR position and observe that the green ELECTRIC DETONATOR READY light is on and the ARMED light is off.

2.11.8.1.06 On each remote, depress the two spring-loaded binding posts and insert the leads of the test lamps.

2.11.8.1.07 On the controller, press the ARM switch. The ARMED lights for the selected remote units will blink for up to 15 seconds and come on steady.

2.11.8.1.08 On each remote unit, the red ARMED light will come on steady. The system is armed.

2.11.8.1.09 On the controller, before 2 minutes have elapsed, press the DISARM switch. All remotes will disarm within 3 seconds.

2.11.8.1.010 Re-arm the controller unit and wait 2 minutes. After the 2 minutes, all remotes will return to the disarmed state. The red ARMED lights will go out, and the green READY lights will come on steady.

2.11.8.1.011 Re-arm the controller unit and before the 2 minutes have expired, press both FIRE switches together and hold for half a second. You should notice that all test lamps light briefly. All units subsequently return to the disarmed state.

2.11.8.1.012 Turn off all units. Restore antennas, test lamps as required. The system is now operationally ready for use.

2.11.8.2 Setting Up the Remote Firing Device

2.11.8.2.01 Select the number of remotes (EEG will use no more than two remotes) required for the operation. Ensure that all units are sufficiently charged and tested.

2.11.8.2.02 Ensure that the controller unit key is removed. Position the controller unit at the intended firing position and install the antenna.

2.11.8.2.03 Select a position for the remote unit close to the blast area but far enough to ensure that the remote is safe from direct air blasts and falling rocks.

2.11.8.2.04 Install the antenna on the remote unit. Ensure that the antenna is free of obstruction.

2.11.8.2.05 Turn the POWER switch to the ON position. Observe that the yellow POWER light is on and not flashing. Ensure that the battery voltage is above 12.0 V.

2.11.8.2.06 For surface operation, the green RECEIVE light suggests the presence of an interfering radio signal or noise. The RECEIVE light is similar to breaking squelch on a hand-held radio and does not necessarily indicate that operation is degraded.

2.11.8.2.07 Place the SELECT switch to the ELECTRIC DETONATOR position. Verify that the green READY light is on, while the red ARMED light remains off.

2.11.8.2.08 Install the two-wire firing cable extension into the spring-loaded binding posts located on the left side of the remote unit.

2.11.8.2.09 Install the enable key into the remote unit and observe that the yellow light next to the ENABLE KEY begins flashing. If the controller is in SAFETY POLL mode, this light will turn on steady within 15 seconds to show that full two-way communications are working.

2.11.8.2.010 Close the lid on the remote for protection.

2.11.8.3 Firing the Remote Firing Device

2.11.8.3.01 Activate the controller unit by pressing the ON switch. Observe that the yellow POWER light is on. The controller should be recharged when the BATTERY indicator reads 20% or less.

2.11.8.3.02 When the area is clear and all shots are prepared, insert the key into the controller unit. The yellow KEY light will turn on.

2.11.8.3.03 Press the SELECT switches to select the remote units to be fired. The yellow SELECT light will illuminate as the corresponding remote is selected.

2.11.8.3.04 Press the STATUS switch and observe that the green READY light will light for each selected remote unit that is operational and within range.

2.11.8.3.05 Yell, three times: “Fire in the hole!” About 30 seconds from firing, press and hold the ARM switch for half a second. The red ARMED lights will blink for up to 15 seconds and come on steady.

2.11.8.3.06 When ready to fire, press the two FIRE switches together at the same time and hold for half a second. Shot initiation should be detected.

2.11.8.3.07 After a short time, the green READY lights should be on steady to show that each remote unit has fired and is now disarmed. Any lights that continue to blink indicate that the controller did not receive a confirming message and a manual STATUS check is required to ensure that all units are disarmed.

2.11.8.3.08 With all deployed remote units having reported steady READY status, deactivate the controller by pressing the OFF switch.

2.11.8.3.09 Remove the controller unit’s key.

2.11.8.3.010 Wait an additional 2 minutes; then, following standard safety procedures, you may approach and retrieve the remote units.

2.11.8.3.011 Turn OFF the remote units. Remove and store the enable keys and antennas.

2.11.8.3.012 Inspect all units for physical damage. Close the lids and restore dust caps.

2.11.9 Procedures for Detonating Cord Use

2.11.9.01 The detonating cord should be cut using approved crimpers, and only the amount required should be removed from the inventory.

2.11.9.02 When cutting the detonating cord, the task should be performed outside the magazine.

2.11.9.03 For ease of inventory control, measure the detonating cord in 1-foot increments.

2.11.9.04 The detonating cord should not be placed in clothing pockets or around the neck, arm, or waist, and should be transported to the demolition location in either an approved “day

box" or a cloth satchel, depending upon the magazine location and proximity to the demolition area.

2.11.9.05 The detonating cord should be placed at least 25 feet away from detonators and demolition materials until ready for use. To ensure consistent safe handling, each classification of demolition material shall be separated by at least 25 feet until ready for use.

2.11.9.06 When ready to "tie in" the detonating cord to either demolition materials or the detonator, the detonating cord will be connected to the demolition material and secured to the MEC. The detonating cord is then strung out of the hole and secured in place with soil, making sure to leave a 1-foot tail exposed outside the hole.

2.11.9.07 Once the hole is filled, make a loop in the detonating cord that is large enough to accommodate the detonating cord detonator, place the detonator in the loop, and secure it with tape. The explosive end of the detonator will face down the detonating cord toward the demolition material or parallel to the main line.

2.11.9.08 In all cases, make sure that sufficient detonating cord extends out of the hole to allow for ease of detonator attachment and detonator inspection or replacement should a misfire occur.

2.11.9.09 If the detonating cord detonators are electric, they will be checked, tied in to the firing line, and shunted before being taped to the loop. If the detonating cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place before taping the detonators to the detonating cord loop.

2.11.9.010 In the event that a time/safety fuse is used, and an igniter is not available and a field-expedient initiation system (i.e., matches) is used, do not split the safety fuse until the detonator is taped into the detonating cord loop.

2.11.10 Procedures for Time / Safety Fuse Use

2.11.10.01 Before each daily use, the burn rate for the time/safety fuse must be tested to accurately determine the length of time/safety fuse needed to achieve the minimum burn time of 5 minutes needed to conduct demolition operations. A section of time fuse shall never be less than 6 feet long.

2.11.10.02 To ensure that both ends of the time/safety fuse are moisture-free, use approved crimpers to cut 6 inches off the end of the time/safety fuse roll and place the 6-inch piece in the time/safety fuse container.

2.11.10.03 If quantity allows, accurately measure and cut off a 3-foot-long piece of the time/safety fuse from the roll.

2.11.10.04 Take the 3-foot section out of the magazine and attach a fuse igniter.

2.11.10.05 In a safe location away from demolition materials and MEC, ignite the time/safety fuse, measure the burn time from the point of initiation to the other end, and record the burn time in the demolition supervisor's log book.

2.11.10.06 To measure the burn time, use a watch with a second hand or chronograph.

2.11.10.07 To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.

2.11.10.08 Whenever a time/safety fuse is used for demolition operations, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of 5 minutes. A section of time fuse shall never be less than 6 feet long.

2.11.11 Procedures for Perforator Use

2.11.11.01 Perforators will be used for venting suspected MEC and MC prior to inspection for disposal. The following procedures must be followed when perforators are used.

2.11.11.02 Remove from inventory only the number of perforators required to perform the task.

2.11.11.03 Transport perforators in an approved "day box," cloth satchel, or plastic container, depending upon magazine location and proximity to the demolition operations.

2.11.11.04 Keep perforators stored at the demolition site at least 25 feet away from detonators and demolition materials until ready for use.

2.11.11.05 When ready to use, place the detonating cord through the slot on the perforator and knot the detonating cord, making sure that the detonating cord fits securely and has good

continuity with the perforator. Perforators requiring special clips would be attached to the detonation cord, using the clips, in accordance with the manufacturer's directions.

2.11.11.06 Once the detonating cord is secure, place the perforator in the desired location and secure it in place.

2.11.12 Procedures for Binary Explosives Use

2.11.12.01 The following procedures must be followed when binary explosives are used as demolition material.

2.11.12.02 Remove from inventory only the amount of binary explosives required to perform the task.

2.11.12.03 In transporting the solid and liquid components, they need only to be placed apart in the bed of a truck or boat.

2.11.12.04 Do not mix the solid and liquid components until it is certain that the binary explosives will be used, since the resulting mixture is classified by the Department of Transportation as a Class 1.1 explosive.

2.11.12.05 When mixing the solid and liquid components, follow the manufacturer's instructions and wear rubber gloves and goggles. Mix components in an area away from other demolition materials the MEC and, if possible, sheltered from the wind.

2.11.12.06 Once the components have been mixed, it is essential that the lid to the solid bottle is put on securely as soon as possible after mixing to prevent evaporation of the liquid.

2.11.12.07 Attach the detonating cord as recommended by the manufacturer, place the assembled unit in the desired location in the hole, and secure the unit.

2.11.12.08 Proceed from this point as described in Subchapter 2.11.8.

2.11.13 Meteorological Conditions

2.11.13.01 To control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements shall apply to demolition operations.

2.11.13.02 Demolition operations will not be conducted during electrical storms or thunderstorms.

2.11.13.03 Demolition operations will not be conducted during periods of visibility of less than 1 mile.

2.11.13.04 Demolition shall not be carried out on extremely cloudy days, which are defined as overcast (more than 80 percent cloud cover) with a ceiling of less than 2,000 feet.

2.11.13.05 Demolition operations will not be conducted during any atmospheric inversion condition (low or high altitude).

2.11.13.06 Demolition operations will not be conducted during periods of local air quality advisories.

2.11.13.07 Demolition operations will not be initiated until 30 minutes after sunrise and will be completed at least 30 minutes before sunset.

2.12 Pre-Demolition and Disposal Operations

2.12.1 Operational Briefing

The demolition supervisor will brief all personnel involved in demolition operations in the following areas:

- Type of MEC being destroyed
- Type, placement, and quantity of demolition material being used
- Use of sandbags for mitigation of fragmentation and blast effects
- Method of initiation (electric or non-electric)
- Means of transporting and packaging MEC
- Route to the disposal site
- Equipment being used (e.g., galvanometer, blasting machine, firing wire)
- Misfire procedures
- Fire-prevention procedures
- Post-shot cleanup of demolition area

2.12.2 Safety Briefing

The UXOQC/SO will conduct a safety briefing for all personnel involved in demolition operations on the following topics:

- Care and handling of explosive materials
- Personal hygiene
- Two-man rule and approved exceptions
- Potential trip and fall hazards
- Horseplay on the range
- Staying alert for any explosive hazards on the range
- Location of emergency shelter (if available)
- Parking area for vehicles (vehicles must be positioned for immediate departure, with the keys in the ignition)
- Location of range emergency vehicle (keep engine running)
- Wind direction (to assess potential toxic fumes)
- Location of first aid kit and fire extinguisher
- Route to nearest hospital or emergency aid station
- Type of communications in event of an emergency
- Storage location of demolition materials and MEC awaiting disposal
- Expected endangered species at each site, their locations, and protective measures

2.12.3 Task Assignments

Individuals with assigned tasks will report the completion of the task to the demolition supervisor. Tasks that may be required include:

- Contacting local police and fire personnel, USCG, and Federal Aviation Administration
- Contacting hospital or emergency response personnel if applicable
- Securing all access roads to the range area
- Visually checking range for any unauthorized personnel
- Checking firing wire for continuity and shunt
- Preparing designated pits as required
- Checking continuity of detonators
- Checking time/safety fuse and its burn rate
- Designating a technician to maintain custody of blasting machine or fuse igniters

- Securing detonators in a safe location
- Placing MEC into pit and placing charge in desired location

2.12.4 Preparing Explosive Charge for Initiation

2.12.4.01 Ensure that the firing wire is shunted.

2.12.4.02 Connect the detonator to the firing wire.

2.12.4.03 Isolate or insulate all connections.

2.12.4.04 Place the demolition charge on MEC.

2.12.4.05 Prime the demolition charge.

2.12.4.06 Depart to the firing point (if using non-electrical firing system, obtain head count, pull igniters, and depart to designated safe area).

2.12.4.07 Obtain a head count. Give warning signal, using a bullhorn or siren, 5 minutes before detonation and again at 1 minute before detonation.

2.12.4.08 Yell, three times, “Fire in the hole!” (or an equivalent warning) and take cover.

2.12.4.09 If using an electrical firing system, connect the firing wires to the blasting machine and initiate the charge.

2.12.4.010 Remove the firing wires from the blasting machine and shunt.

2.12.4.011 Remain in a designated safe area until the SUXOS or UXOQC/SO announces, “All clear.” This will be after a post-shot waiting period of 5 minutes and after the SUXOS or UXOQC/SO has inspected the demolition area.

2.13 Post-Demolition and Disposal Procedures

2.13.01 Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so.

2.13.02 The SUXOS or UXOQC/SO will check the pit for low orders, kick-outs, and fires prior to giving the "all clear" signal. The SUXOS and UXOQC/SO are trained and qualified in making these checks.

2.13.03 Search the demolition area to remove any large fragmentation.

2.13.04 Backfill the hole as necessary.

2.13.05 Pick up and store all equipment.

2.13.06 Notify police, fire department, and other appropriate agencies that the operation has been completed.

2.13.07 EEG will attempt to restore to original grade any area impacted by detonations. If the amount of restoration is assessed to be extensive, EEG will contact the contracting officer or representative to discuss a restoration approach. Extensive restoration will be coordinated with the responsible environmental resources agencies.

2.14 Misfire Procedures

A thorough check of all equipment, firing wires, and detonators will prevent most misfires; however, if a misfire does occur, the procedures below shall be followed.

2.14.1 Electrical Misfires

2.14.1.01 To prevent electrical misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire occurs, it must be cleared with extreme caution. The responsible technician will investigate and correct the situation, using the following procedure.

2.14.1.02 Check firing line connections to the blasting machine and make a second attempt to initiate the charge.

2.14.1.03 If unsuccessful, disconnect and connect to another blasting machine (if available) and attempt to initiate the charge.

2.14.1.04 If unsuccessful, wait 30 minutes.

2.14.1.05 After the 30-minute period plus any other predicted delay for any part of the shot has passed, proceed down range to inspect the firing system. A safety observer must watch from a protected area.

2.14.1.06 Remove and disconnect old blasting cap(s), and shunt the wires.

2.14.1.07 Follow normal procedures for effecting initiation of the charge.

2.14.2 Electrical Misfire Procedures for Remote Firing Device

2.14.2.01 If the shot does not initiate, then arm and fire immediately at least three times. If there is still no initiation, press DISARM and verify that the GREEN READY light is illuminated within 10 seconds.

2.14.2.02 If the GREEN READY light does not illuminate, then wait 2 minutes for the AUTO DISARM function to enable. At the end of the 2 minutes, follow the standard misfire approach procedure outlined in Section 2.14.1 above.

2.14.2.03 Wait 30 minutes.

2.14.2.04 After the 30-minute period plus any other predicted delay for any part of the shot has passed, proceed down range to inspect the firing system. A safety observer must watch from a protected area.

2.14.2.05 Remove and disconnect blasting cap(s) from the remote firing device and shunt the wires.

2.14.2.06 Follow normal procedures for effecting initiation of the charge.

2.14.3 Non-Electrical Misfires

2.14.3.01 Working on a non-electrical misfire is the most hazardous of all operations. Occasionally, despite all painstaking efforts, a misfire will occur. Investigation and corrective action should be undertaken only by the technician that placed the charge, using the following procedure.

2.14.3.02 If the charge fails to detonate at the determined time, initiate a wait period of 60 minutes plus the time of the safety fuse (e.g., 60 minutes plus 5-minute safety fuse for a total 65-minute wait period).

2.14.3.03 After the wait period has expired, proceed down range to inspect the firing system. A safety observer must watch from a protected area.

2.14.3.04 Prime the shot with a new non-electrical firing system and install a new fuse igniter.

2.14.3.05 Follow normal procedures for initiation of the charge.

2.14.4 Detonating Cord Misfire

2.14.4.01 If there is no problem with the initiating system, wait the prescribed amount of time and inspect the initiator to the detonating cord connection to make sure that it is properly connected. If the connection is bad, simply attach a new initiator.

2.14.4.02 If the initiator detonated and the detonating cord did not, inspect the detonating cord to make sure that it is a detonating cord and not a time fuze. Also, check to ensure that there is PETN (pentaerythritol tetranitrate) in the detonating cord at the connection to the initiator. It may be necessary to uncover the detonating cord and replace it. If this is the case, it must done carefully to ensure that the demolition charge and the MEC item are not disturbed.

2.14.5 Perforator Misfire

2.14.5.01 The use of perforators is cost-effective and considerably safer than the use of C-4 and many other demolition materials. If the perforator is not initiated properly, it could malfunction. Since the perforator is covered with tamping material, a detonating cord is used as the initiator; therefore, in the event of a misfire, the procedures presented for detonating cord misfire will be followed.

2.14.5.02 If all explosives were initiated but the perforator, one of four things has occurred: (1) the detonating cord grain size was insufficient to initiate the perforator, (2) the detonating cord was dislodged from the perforator when tamping materials were placed, (3) the perforator was defective, or (4) the perforator was moved during the placement of tamping materials.

2.14.5.03 Check to ensure that the grain size of the detonating cord is sufficient (80-grain or greater is the recommended size).

2.14.5.04 If the detonating cord connection to the perforator was the problem, make sure that the next connection is secure (use duct tape if necessary).

2.14.5.05 If it is evident that the perforator was moved, then make sure that it is properly secured for the next shot.

2.14.5.06 If the detonating cord size and connection are sufficient, replace the perforator, leaving the defective one on the shot.

2.15 Recordkeeping Requirement

2.15.01 To document the demolition operations procedures and the completeness of the demolition of MEC, the following recordkeeping requirements shall be met.

2.15.02 The demolition supervisor will ensure the accurate completion of the logs, and the UXOQC/SO will monitor the entries in the logs for completeness, accuracy, and compliance with meteorological conditions.

2.15.03 The demolition supervisor shall enter the appropriate data on the MEC Accountability Log and the Demolition Shot Log to reflect the MEC destroyed, and shall enter the appropriate information on the Explosives Accountability Record (magazine data card), which indicates the demolition materials used to destroy the MEC.

2.15.04 The quantities of MEC recovered must equal the quantities of MEC destroyed or disposed of as munitions debris.

2.15.05 Copies of Alcohol, Tobacco, and Firearms (ATF) license and Puerto Rico police permits must be on site.

2.16 Engineering Controls

In cases where it is appropriate, shots will be tamped with sand-filled bags to mitigate (defeat) the primary fragments and reduce overpressure and noise. Sandbag mitigation must be performed in accordance with HNC-ED-CS-S-98-7. Water may also be used for mitigation in accordance with HNC-ED-CS-S-00-3. Both reports will be available to the demolition supervisor on site. The buried explosion module (BEM), in accordance with DDESB TP 16, will be used for items larger than 155mm in diameter.

2.17 Procedures for Material Potentially Presenting an Explosive Hazard

2.17.01 All items found at a suspected MEC removal site are deemed to be MPPEH or other materials until the team leader identifies it as being MEC, MC, or munitions debris. The item will be carefully inspected and the intact components identified to the point that the item and any associated fuze can be identified. If the item is inert, it will be removed from the site as munitions debris. If the item is determined to be MEC, the item may be vented for further investigation or destroyed in accordance with Subchapter 2.11. Subchapter 2.18 describes the handling, certification, and disposal of munitions debris and range-related debris.

2.17.02 Munitions debris removal is essential to successfully complete surface clearance. Munitions debris must be inspected to determine that it does not contain explosives or explosive residue, and the casing must be vented to prevent a mechanical rupture if the item were placed in a furnace.

2.17.03 All unopened, fully encased munitions debris will be vented and inspected before it is released to a local scrap dealer.

2.17.04 The following four-step process is used for inspecting and classifying inert munitions debris.

1. UXO Technician II inspects the munitions debris for explosive hazards.
2. UXO Technician III inspects it for explosive hazards (now it may be removed from the pad and consolidated with other munitions debris awaiting verification of being free of explosives).
3. The UXOQC/SO inspects 100 percent of the debris for explosive hazards.
4. SUXOS inspects 100 percent of the debris for explosive hazards.

2.17.05 The items are then placed into a 55-gallon drum, which is sealed, tagged, and labeled.

2.18 Munitions Debris and Range Residue Inspection, Certification, and Final Disposition

EEG personnel will be responsible for the inspection, certification, transport, and final disposition of all munitions debris and range-related debris collected during this effort. The following inspection procedures will be in place to ensure that the exterior and interior surfaces of all recovered items are inspected to verify that these items do not present an explosive hazard.

2.18.1 Responsibilities and Procedures

2.18.1.1 UXO Technician I

UXO Technician I will only tentatively identify a located item as MEC, MC, munitions debris, or other.

2.18.1.2 UXO Technician II

- Inspects each item as it is recovered and determine the following:
  —Is the item MEC, MC, munitions debris (MD), or other miscellaneous debris?
  —Does the item contain explosive hazards or other dangerous filler?
  —Does the item require detonation?
  —Does the item require demilitarization or venting of other dangerous fillers?
  —Does the item require draining of engine fluids, illuminating dials, and other visible liquid HTRW materials?
- Segregates items requiring demilitarization or venting procedures from those items ready for certification.
- At the end of the day, weighs the munitions debris collected and records the weight and source grid or subgrid location on the Grid Sweep Log.

2.18.1.3 UXO Technician III

- Inspects recovered items to determine if they are free of explosive hazards or other dangerous fillers, engine fluids, illuminating dials, and other visible liquid or HTRW materials.
- Supervises detonation of items found to contain explosive hazards or other dangerous fillers and venting or demilitarization procedures.
- Supervises the consolidation and weighing of recovered munitions debris for containerization and sealing.

2.18.1.4 UXO Quality Control / Safety Officer

- Conducts daily audits of the procedures used by UXO teams and individuals for processing munitions debris or range residue.
- Performs inspection of 100 percent of all munitions debris collected from the various teams to ensure that no items with explosive hazards, engine fluids, illuminating dials,

and other visible liquid or HTRW materials are identified as munitions debris, as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.

- Ensures that the Debris Inventory Logs are complete and correct and that the specific procedures for processing munitions debris and range residue for certification as munitions debris are followed, performed safely, and consistent with applicable regulations and in accordance with the USACE-approved project Work Plan.
- Prior to sealing the drums, verifies that the materials secured are free of explosive hazards.

2.18.1.5 Senior UXO Supervisor

- Responsible for ensuring that the Work Plan and the QCP specify the procedures and responsibilities for processing munitions debris and range residue for final disposition.
- Ensures that a Requisition and Turn-in Document, DD Form 1348-1A, is completed for all munitions debris to be transferred for final disposition.
- Performs inspection of munitions debris to satisfy that the munitions debris or range residue is free from explosive hazards (necessary to complete DD Form 1348-1A).
- Certifies that all munitions debris or range residue is free of explosive hazards, engine fluids, illuminating dials, and other visible liquid or HTRW materials.
- Responsible for ensuring that the inspected materials are secured in closed, labeled, and sealed containers and documented. Each container will be closed and clearly labeled on the outside with a unique ID that will include:

  USACE / [*Site name*] / [*Contractor's name*] / [*Sequential container number*, starting with 0001 for the first container] / [*Unique ID number from seal*]

  For example, the label for the first container would read:

  USACE / Culebra / EEG / 0001 / [*Unique ID number from seal*]

  The container will be closed in such a manner that a seal must be broken in order to open the container. The seal will bear the same unique ID number as is placed on the container label. For each container, the following information will be documented: contents, estimated weight of container, location where munitions debris was obtained, name of contractor, names of certifying and verifying individuals, and unique container and seal ID. This information will be submitted in the final report.

2.18.2 Munitions Debris Certification and Verification

2.18.2.01 The SUXOS will ensure that munitions debris generated from removal operations is properly inspected in accordance with the procedures described above in Responsibilities and Procedures. Only qualified UXO personnel will perform these inspections. The UXOQC/SO will first inspect 100 percent of the scrap. The SUXOS will reinspect 100 percent of the scrap prior to certifying that the munitions debris is free of explosive hazards. The CEHNC safety specialist will verify that the munitions debris is free of explosive hazards. In the event that a CEHNC safety specialist is not on site to verify the munitions debris, the UXOQC/SO shall verify the munitions debris in accordance with Attachment A of the SOW (Appendix A).

2.18.2.02 DD Form 1348-1A will be used as certification/verification documentation. Each DD Form 1348-1A must clearly show the typed or printed names of EEG's SUXOS and USACE's OE safety specialist, contractor's name (i.e., EEG), signature of SUXOS, and contractor's home office and field office phone number(s) of the persons certifying and verifying the munitions debris.

2.18.2.03 In addition to the data elements required, the DD Form 1348-1A must clearly indicate the following for scrap metal:

- Basic material content (type of metal, e.g., steel or mixed)
- Estimated weight
- Unique ID of each container and seal
- Location where munitions debris was obtained
- Seal ID, if different from the unique ID of the sealed container

2.18.2.04 The following certification/verification will be entered on each DD Form 1348-1A for turnover of munitions debris and will be signed by the SUXOS and a CEHNC safety specialist:

> This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, is free of explosive hazards, engine fluids, illuminating dials, and other visible liquid or HTRW materials.

2.18.3 Maintaining Chain of Custody and Final Disposition

2.18.3.01 EEG, in coordination with CEHNC, will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will be released only to an organization that will:

- Upon receiving the unopened labeled containers, each with its uniquely identified and unbroken seal ensuring a continued chain of custody, and after reviewing and concurring with all of the provided supporting documentation, provide a signed statement that it has received and agrees with the provided documentation that the sealed containers contain no explosive hazards when received. The signed statement will be on company letterhead and will state that the contents of these sealed containers will not be sold, traded, or otherwise given to another party until the contents have been shredded, or flashed, and are identifiable only by their basic content.
- Send to EEG notification and supporting documentation that the contents of the sealed containers have been shredded and are now identifiable only by their basic content.

2.18.3.02 These documents will be incorporated into the final report as documentation supporting the final disposition of this munitions debris.

2.19 Lessons Learned

Procedures for recording, reporting, and implementing lessons learned are included in the QCP (Chapter 10).